IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF	: Gaku MINAMIHABA et al.
SERIAL NUMBER	: USA Patent Application No. 10/762,514
FOR	: SLURRY FOR CHEMICAL MECHANICAL POLISHING FOR COPPER AND METHOD OF MANUFACTURING SEMICONDUCTOR DEVICE USING THE SLURRY
FILED	: JANUARY 23, 2004
GROUP ART UNIT	: 1765

DECLARATION UNDER 37 C.F.R. 1.132

Hon. commissioner for patents and trademarks
Washington, D.C. 20231

Sir:

1. I am a co-inventor of the present invention described and claimed in the above-identified application and reside in 1-56-9, Ise-cho, Nishi-ku, Yokohama-shi, Kanagawa-ken, Japan.

2. I graduated from Iwate Prefectural Kamaishi Technical High School in March 1989. I was employed by TOSHIBA in April 1989, and have been engaged in research on the manufacturing process of semiconductor devices.

3. I conducted the following Experiment to establish that a polishing slurry including six components of the present invention exhibits a higher polishing rate, higher polishing rate stability, and lower dishing than a polishing slurry which lacks any one of the six components.

More particularly, the following were employed as components of the polishing slurry.

Component A: a mixture of quinaldinic acid and quinolinic acid

Component A': only quinaldinic acid

Component B: ammonium persulfate

Component C: colloidal silica

Component D: glycine

Component E: potassium dodecylbenzenesulfonate

Component F: acetylene diol ethylene oxide adduct

The following eight kinds (Sample Nos. 1-8) of polishing slurries including the above-listed components were prepared.

Sample No. 1

Component A': 0.5 wt%

Component B: 2.0 wt%

Component C: 0.5 wt%

Component D: 0.25 wt%

Component E: 0.05 wt%

Component F: 0.1 wt%

Sample No. 2

Component B: 2.0 wt%

Component C: 0.5 wt%

Component D: 0.25 wt%

Component E: 0.05 wt%

Component F: 0.1 wt%

Sample No. 3

Component A: 0.3 wt% quinolinic acid and 0.2 wt% quinaldinic acid

Component C: 0.5 wt%

Component D: 0.25 wt%

Component E: 0.05 wt%

Component F: 0.1 wt%

Sample No. 4

Component A: 0.3 wt% quinolinic acid and 0.2 wt% quinaldinic acid

Component C: 2.0 wt%

Component D: 0.25 wt%

Component E: 0.05 wt%

Component F: 0.1 wt%

Sample No. 5

Component A: 0.3 wt% quinolinic acid and 0.2 wt% quinaldinic acid

Component C: 2.0 wt%

Component D: 0.5 wt%

Component E: 0.05 wt%

Component F: 0.1 wt%

Sample No. 6

Component A: 0.3 wt% quinolinic acid and 0.2 wt% quinaldinic acid

Component B: 2.0 wt%

Component C: 0.5 wt%

Component D: 0.25 wt%

Component F: 0.1 wt%

Sample No. 7

Component A: 0.3 wt% quinolinic acid and 0.2 wt% quinaldinic acid

Component B: 2.0 wt%

Component C: 0.5 wt%

Component D: 0.25 wt%

Component E: 0.05 wt%

Sample No. 8

Component A: 0.3 wt% quinolinic acid and 0.2 wt% quinaldinic acid

Component B: 2.0 wt%

Component C: 0.5 wt%

Component D: 0.25 wt%

Component E: 0.05 wt%

Component F: 0.1 wt%

Of the above-listed eight kinds of polishing slurry samples, Sample Nos. 1-7 are polishing slurry samples of comparative examples,

and only Sample No. 8 is a polishing slurry sample of the present invention.

Through the use of the above-listed eight kinds of polishing slurry samples, a Cu film with a thickness of 2 μm formed on a silicon wafer was polished by CMP.

The polishing was performed under the following conditions.

Flow rate of the polishing slurry samples: 300cc/min

Polishing pad: IC1000 (tradename; Rodel Co., Ltd.)

Load: 300g/cm^2

The Cu polishing rate (removal rate), Cu polishing rate stability, and Cu dishing were assessed by the following standard.

Cu polishing rate

O: greater than or equal to 1,000nm/min

X: less than 1,000nm/min

Cu polishing rate stability

The polishing treatment was continuously performed on 24 sheets of silicon wafers coated with Cu films. The stability was assessed on the basis of whether the polishing rate of the first sheet was less than or equal to ±10% or greater than ±10%.

O: less than or equal to ± 10%

X: greater than 10%

Cu dishing

O: less than or equal to 30nm

X: greater than 30nm

The following list shows the result of the assessment.

Sample No.	Cu polishing rate	Cu polishing rate stability	Cu dishing
1 (A'+B+C+D+E+F)	O	X	O
2 (B+C+D+E+F)	X	O	X
3 (A+C+D+E+F)	X	X	X
4 (A+B+D+E+F)	X	X	X
5 (A+B+C+E+F)	X	X	X
6 (A+B+C+D+F)	O	O	X
7 (A+B+C+D+E)	X	X	X
8 (A+B+C+D+E+F)	O	O	O

The following conclusion can be drawn from the list shown above.

Sample No. 8, which includes all the six components of A, B, C, D, E and F, is excellent in all the properties of Cu polishing rate (removal rate), Cu polishing rate stability, and Cu dishing. On the other hand, the other samples, i.e., Sample No. 1, which employs Component A' including only quinaldinic acid, Sample No. 2, which does not include Component A, Sample No. 3, which does not include Component B, Sample No. 4, which does not include Component C, Sample No. 5, which does not include Component D, Sample No. 6, which does not include Component E, and Sample No. 7, which does not include Component F, are inferior in any one of the properties and do not satisfy all the properties.

The undersigned petitioner declared further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

Signature

June 7, 2006
Date